Report

04/26/05

Following is a summary of last week's literature survey:

1. Electrochemical Corrosion Potential – Ordered a potentiostat to measure ECP. ECP measurement will be required to utilize the Pourbaix diagram.

   ECP is the Open Circuit Potential of the cell. The potentiostat provides a very high resistance in the circuit and hence almost no current flows between the two electrodes in the absence of any externally applied potential. Open Circuit Potential is the potential that the potentiostat measures between the two electrodes in this condition.

   We need two electrodes. The reference electrode is included in the potentiostat. We have to include a Cu piece in the circuit as a working electrode. Determination of the size of Cu piece requires additional study.

2. Corrosion in APS water system –

   In the Galvanic series the position of Copper is above Stainless steel. That means Copper is the sacrificing material when used along with Stainless steel in the same aqueous system. A smaller anode (copper) compared to the cathode (stainless steel) makes the situation worse.

   From the Galvanic point of view, since APS water system contains both Stainless steel and Copper components, copper corrosion will continue to occur. Research should be performed to determine the effect of water chemistry on this corrosion rate.

3. Corrosion rate –

   Apart from our plan of indirect measurement of corrosion rate by using coupons, we can determine theoretical corrosion rate from Tafel Plots. Tafel Plot is a plot of applied voltage vs current density. Both of these can be measured by the potentiostat.

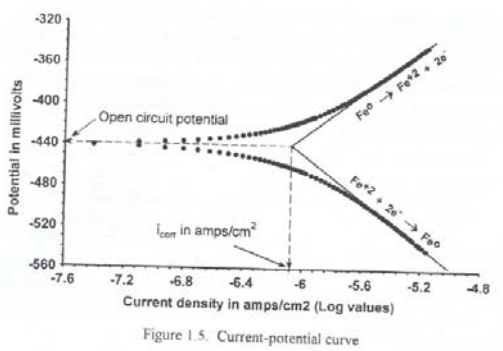

Figure 1.5. Current-potential curve

Fig: Tafel Plot for Fe

Also, Corrosion Rate = I_{corr}* Λ* 1/ρ* Є

Where, Λ = 1.2866 x 10^5 [equivalents.sec.mils] / [Coulombs.cm.years]
ρ = Metal Density
Є = Equivalent weight in grams/equivalent. Equivalent weight is a metal's gram molecular weight divided by the number of electrons in a metal's anodic half reaction.

Practical application of this method needs further study.

4. Glidcop – Studied general composition and properties from the website. [Ref: http://www.aps.anl.gov/asd/me/]

   The alloy is dispersion strengthened by Al-oxide particles that are inert to the Cu matrix. Dispersion strengthening greatly improves mechanical properties of the copper matrix, especially at high temperatures. Thermal and electrical conductivity drops a little compared to pure Copper. As the amount of Al oxides increase these effects become more prominent.

5. Tour inside the storage ring
6. Completed primary & secondary water system study